Impaired placental nutrient transport in mice generated by in vitro fertilization.

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Authors: Enrrico Bloise, Wingka Lin, Xiaowei Liu, Rhodel Simbulan, Kevin S Kolahi, Felice Petraglia, Emin Maltepe, Annemarie Donjacour, Paolo Rinaudo

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Public Summary:
More than 4.5 million children have been conceived by in vitro fertilization (IVF). Interestingly, singleton IVF offspring born at term have an increased incidence of low birth weight. The mechanism responsible for the lower birth weight is unknown, but alterations in placental function are possible. Hence, the goal of our study was to examine placental growth and function in mice generated in vivo or in vitro. To assess placental function, blastocysts were generated by IVF or produced by natural mating (control group); both IVF and control blastocysts were transferred to pseudopregnant recipients. Placental weights did not differ at embryonic d 15.5 (E15.5) but were increased at E18.5 in the IVF group (25.4%, $P < 0.001$) compared with control. Proliferation was increased in IVF placentae, whereas overall placental gross morphology and apoptosis were not affected. Both fetal weights (16.4% lower at E15.5 and 8.8% lower at E18.5, $P < 0.05$) and fetal to placental ratios were lower ($P < 0.001$) in the IVF compared with the control group at both time points, whereas birth weights did not differ. At E18.5, the mRNA for selected glucose, system A amino acid transporters, and imprinted genes were down-regulated in IVF placentae. GLUT3 protein level was decreased in the IVF group ($P < 0.05$). Importantly, intrajugular injections of (14)C-methyl-D-glucose or (14)C-MeAIB tracers ($n = 6$ litters per group) showed that placental transport of glucose and amino acids were 24.8% (not significant) and 58.1% ($P < 0.05$) lower in the IVF group. Fetal accumulation of glucose was not different, but amino acid accumulation was significantly (36 %) lower in IVF fetuses ($P < 0.05$). We conclude that IVF alters both fetal and placental growth and, importantly, decreases placental transport efficiency in mice conceived by IVF.

Scientific Abstract:
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